# Notes on the morphology and ecology of the Lesser Whistling Teal (*Dendrocygna javanica*)[1]

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Problems associated with ecological isolation have long been central to evolutionary biology, as noted in the comprehensive review by Lack (1971). Moreover, among the waterfowl family Anatidae, the basic ecology of the eight species of whistling or tree ducks (*Dendrocygna* spp.) remains relatively unknown despite some studies of the New World species. Accordingly, we earlier developed a model and analysis that correlated morphological and ecological features for two species of whistling ducks sympatric in North America (Rylander & Bolen 1970). Among the features analyzed was the disproportionately larger foot size, as measured by middle toe length, for the otherwise smaller Fulvous Whistling Duck (*D. bicolor*) in comparison with the Black-bellied Whistling Duck (*D. autumnalis*).

Siegfried (1973) subsequently examined a second sympatric pair of whistling ducks in Africa, *D. bicolor* and the White-faced Whistling Duck (*D. viduata*), and found a similar divergence in foot size consistent with his observations of their respective ecological roles (i.e. divergence in the extent of their aquatic feeding habits). We later were able to demonstrate a comparable situation for two additional species sympatric in Australia (Bolen & Rylander 1974). Our model was also applied to the feeding apparatus and gaits of the Australian and North American species (Rylander & Bolen 1974a, b), including phenetic data suggesting parallel evolution between *D. autumnalis* in North America and the Plumed Whistling Duck (*D. eytoni*) in Australia.

As *D. bicolor* and the Lesser Whistling Teal (*D. javanica*) occur sympatrically throughout much of the Indian subcontinent, and thus represent still another example for study, we wish now to report on the foot morphology of the latter species, to compare these data with its Indian congener, and to offer suggestions concerning the ecological isolation that perhaps affected this pair of species.

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## Methods

Twenty-seven *D. javanica* specimens housed at the Bombay Natural History Society were measured with vernier calipers for tarsal, middle toe, and exposed culmen lengths. Except for one specimen from Sri Lanka, all specimens were collected in India.

Unfortunately, published ecological data are scarce for *D. javanica*. Scattered references dealing qualitatively with food habits and nesting have necessarily been used in this report in lieu of quantitative information. Similarly, the habits of *D. bicolor* are not well known in India although approximations concerning this species' foods and nesting ecology may be reasonably drawn from studies elsewhere in its range.

## Results

Mean linear dimensions for *D. javanica* appear in Table 1. These data well reflect the size of this species as the smallest among the eight species in the genus. Delacour (1954:44) provides the following additional size data (mm) for an unspecified number of birds:

wing: 170-204 tail: 53-55 culmen: 38-42 tarsus: 40-50

Table 1

Mean linear measurements (mm) for 27 Lesser Whistling Teal (*D. javanica*)[1]

| Feature | Adults[2] (N = 16) | Immatures[3] (N = 11) | All birds (N = 27) |
|---|---|---|---|
| Culmen | 41.5 (39.0-45.7) 1.9 | 39.7 (37.1-42.6) 1.4 | 40.7 (37.1-45.7) 1.9 |
| Tarsus | 45.7 (42.7-48.6) 2.0 | 45.2 (41.3-48.2) 1.8 | 45.5 (41.3-49.8) 1.9 |
| Middle toe | 60.3 (55.5-63.8) 2.1 | 60.0 (56.5-64.1) 2.2 | 60.2 (55.5-64.1) 2.1 |

[1] Data shown are mean, range, and standard deviation.
[2] Includes 5 males, 6 females and 5 unsexed birds.
[3] Includes 6 males, 4 females and 1 unsexed bird.

The diminutive stature of *D. javanica* can be further appreciated when it is compared with Delacour's (1954:43) measurements (mm) of the Black-bellied or Cuban Whistling Duck (*D. arborea*), the largest of the genus:

wing: 230-270 tail: 100-105 culmen: 45-53 tarsus: 62-75

Whereas comparisons of linear data for sympatric pairs of whistling ducks in Australia, North America, and Africa uniformly show that one species in each pair has a disproportionately larger foot than the second and otherwise larger member of each pair, a similar comparison between the whistling ducks sympatric in India does not show this relationship (Table 2). *D. javanica* is about eight to nine-tenths the size of *D. bicolor,* including foot size as measured by middle toe length. In other words, neither of these two species is morphologically better suited for aquatic life than the other, if we apply the criterion established for the other pairs of whistling ducks shown in Table 2. Thus, *D. javanica* and *D. bicolor* are not ecologically isolated by morphological differences related to securing food in different habitats (meadows, fields and shallow water vs. deep water), a strategy seemingly employed elsewhere among other sympatric pairs (Bolen & Rylander 1974; Siegfried 1973).

Table 2

Proportionate sizes between four sympatric pairs of whistling ducks

| Feature | Africa[1] | North America[2] | Australia[3] | India[4] |
|---|---|---|---|---|
| | *D. bicolor/ D. viduata* | *D. bicolor/ D. autumnalis* | *D. arcuata/ D. eytoni* | *D. javanica/ D. bicolor* |
| Wing | 0.94 | 0.88 | 0.92 | 0.88 (0.87)[6] |
| Culmen | 0.92 | 0.88 | —[5] | 0.87 (0.88) |
| Tarsus | 0.97 | 0.89 | 0.88 | 0.82 (0.89) |
| Middle toe | 1.15 | 1.03 | 1.18 | 0.90 (0.92) |

[1] Analyzed by Siegfried (1973) based on measurements of 10 of each species except for middle toe where 7 *bicolor* and 8 *viduata* were examined.

[2] Analyzed by Rylander & Bolen (1970) based on measurements of 21 *autumnalis* examined by Bolen (1964) and 28 *bicolor* measured by Friedmann (1947).

[3] Analyzed by Bolen & Rylander (1974) based on measurements of 3 *arcuata* and 6 *eytoni,* plus wing data from birds examined by Frith (1967).

[4] Data from 27 *javanica* shown in Table 1. First column, below, uses *bicolor* measurements from Rylander and Bolen (1970); second column, in parenthesis, uses *bicolor* measurements from Siegfried (1973).

[5] The bill of *eytoni* is remarkably short, and singularly dissimilar from any of the other 7 species of *Dendrocygna;* this precluded use of culmen measurements as a useful indicator of size relationships in this instance.

[6] Wing size was determined from the unweighed average (187 mm) of the extreme measurements (170-204 mm) listed by Ali & Ripley (1968:139) for *javanica.*

We therefore suggest a second strategy leading to ecological isolation, namely that *D. javanica* and *D. bicolor,* while in fact exploiting the same habitats with similar swimming and diving capabilities, secure vastly different foods. This strategy is rather common, accounting for fully 48 per cent of the isolation among European waterbirds as compared with 19 per cent frequency where isolation is maintained by no contact at all or 18 per cent where habitat selection provides the ecological barrier (Lack 1971:125, Table 18).

## Intrageneric phylogeny

In each of the geographic comparisons shown in Table 2, with the exception of India, no species within any sympatric pair are known to be particularly close in their phylogeny. For example, *D. autumnalis* and *D. bicolor* were shown to be rather distantly related in a correlation phenogram employing 35 presumably non-adaptive features (Rylander & Bolen 1974a). However, in the present analysis, a close phylogenetic relationship may exist between *D. bicolor* and *D. javanica* (and also including *D. arcuata*). These three species perhaps form a superspecies complex as first suggested by Ripley (1945). The similarity in their body proportions, with particular regard to the ecological implications of their respective toe/tarsus ratios, is shown in Table 3. Accordingly, one might expect a priori that *D. javanica* and *D. bicolor,* if not diverging greatly in appearance and form, may have nonetheless done so in their food habits, thus fostering the second strategy of ecological isolation previously mentioned.

Table 3

Proportions among linear dimensions for 3 closely-related species of *Dendrocygna*

| Ratio | *D. arcuata*[1] | *D. bicolor*[2] | *D. javanica* |
|---|---|---|---|
| Wing/tarsus | 4.1 | 3.8 (4.1) | 4.1[3] |
| Wing/toe | 3.3 | 3.2 (3.3) | 3.1 |
| Toe/tarsus | 1.3 | 1.2 (1.3) | 1.3 |

[1] Analyzed by Bolen and Rylander (1974).

[2] First column, below, uses *bicolor* measurements from Rylander and Bolen (1970); second column, in parenthesis, used *bicolor* measurements from Siegfried (1973).

[3] Wing size was determined from the unweighed average (187 mm) of the extreme measurements (170-204 mm) listed by Ali & Ripley (1968:139) for *javanica.*

## Comparative ecology

*D. bicolor*: This is one of the better-studied species of whistling ducks, perhaps because of its extensive distribution in North and South America, Africa, and portions of Asia. Rylander & Bolen (1970) noted the disproportionately large foot of this species and suggested that this feature was in keeping with its aquatic associations; the gait of *D. bicolor,* also quantitatively studied, is distinctively unlike the cursorial species of whistling duck (Rylander & Bolen 1974a).

Inconsistences appear in the literature regarding the nesting habits of *D. bicolor*. Perhaps these are due to ecological variation throughout its vast range (even though there are no acceptable geographical races). In any case, *D. bicolor* does not nest in trees or even perch on branches in Texas, California and Louisiana but instead nests in rice fields or dense clumps of marsh grasses (Dickey & Van Rossem 1923; Meanley & Meanley 1959; Cottam & Glazener 1959). Yet in India, Ali & Ripley (1968:140) described their nests as roughly built of sticks in hollow trees or in the forks of branches or, as with *D. javanica*, in abandoned nests of kites and crows.

The food of *D. bicolor* in India is not documented in the literature available to us. Elsewhere, their food consists of the seeds of grasses and sedges, and, in season, commercial rice (*Oryza sativa*). *Paspalum, Echinochloa,* and *Fimbristylis* each comprised 45 per cent or more of the spring and fall foods examined by Meanley & Meanley (1959) in Louisiana; no animal foods were reported. Moreover, our analysis of this species' bill structure indicated that food was secured by sieving action (Rylander & Bolen 1974b), presumably in the quest of seeds.

*D. javanica*: This small and interesting bird seemingly possesses traits found in one or more of the other species of *Dendrocygna* as well as some uniquely its own. Ali (1969:40) and Ali & Ripley (1968:138) note that the species perches freely in trees yet walks and dives well. Henry (1955:411) similarly observes that it walks well on land, with a slight waddle, but that the birds' "true home is in the water where it swims powerfully and dives readily—both in play and for food—descending to at least 6-8 feet and remaining submerged for many seconds on occasion."

There are regrettably only general accounts of this species' nesting habitat and these, again, indicate a remarkable amplitude. For example, Whistler (1949:523) reports nests on the ground or slightly elevated in masses of dense herbage whereas the "ordinary nest is in a tree, either in the deserted nests of crows and kites, or in hollows in the trunks and branches or between the boughs." Ali & Ripley (1968:139) also note the foregoing and add that nests among reeds and scrub bordering a jheel are fairly substantial pads of leaves, rushes, and grass.

The foods of *D. javanica*, like the sites of its nests, again sets this species apart from what is known of other dendrocygnid food habits. However, there has been no systematic study of a series of stomach or crop contents from any portion of *D. javanica's* range. Dharmakumarsinhji (n.d., p. 100) reports that plant materials as well as fish and insects are secured by upending or diving. Worms, snails, fish, and even frogs and other animal matter are listed by Ali (1969:40) in addition to shoots and grain. In Ceylon, Henry (1955:411) cites that whereas a vegetable diet seems preferred, large quantities of molluscs are devoured. *D. java-*

*nica* may graze "like a goose" yet it also eats rice and small fish, frogs, and worms and snails (Ali & Ripley 1968:139). Baker (1908:103) noted that large quantities of a brittle-shelled freshwater snail are ingested, an observation he undoubtedly made from birds taken during the hunting season. Most authors remark, rather emphatically, that the flesh of *D. javanica* is rank and unpalatable, seemingly from the flavour induced by the heavy utilization of animal matter in the diet.

In summary, *D. bicolor* and *D. javanica* appear to have somewhat similar nesting habits, at least in India where nests in trees or in marshlands are employed. The nests of *D. bicolor* are "very like that of lesser whistling teal" (Ali & Ripley 1968:140). However, in the New World, as in Africa (Roberts 1958:52), *D. bicolor* seldom, if ever, perches or nests in trees and instead nests in marshlands. Both are good divers and swimmers. An important difference may be in the utilization of animal foods by *D. javanica* whereas *D. bicolor* feeds exclusively on the seeds of aquatic grasses and weeds.

## Conclusion

Our examination of foot structure, as measured by middle toe length, for the two closely-related species of whistling ducks occurring sympatrically throughout much of India indicates that *D. bicolor* and *D. javanica* exhibit no obvious morphological advantages, one over the other, for aquatic locomotion (cf. Bolen & Rylander 1974). Accordingly, we suggest that these species remain ecologically isolated because of differences in food habits with one (*D. javanica*) selecting large quantities of animal matter and the other (*D. bicolor*) utilizing seeds of marsh plants. However, we stress the need for a quantitative account of stomach and/or crop contents of both species in India so that the matter may be resolved with more clarity. Thereafter a detailed anatomical examination of the feeding apparatus of *D. javanica* might further explain the means by which ecological isolation is maintained (cf. Goodman & Fisher 1962; Rylander & Bolen 1974b). Moreover, the intriguing nesting habits of both species, particularly the utilization of abandoned platform nests of herons and other species requires orderly investigation.

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